INTRODUCTION TO THE ARDUINO

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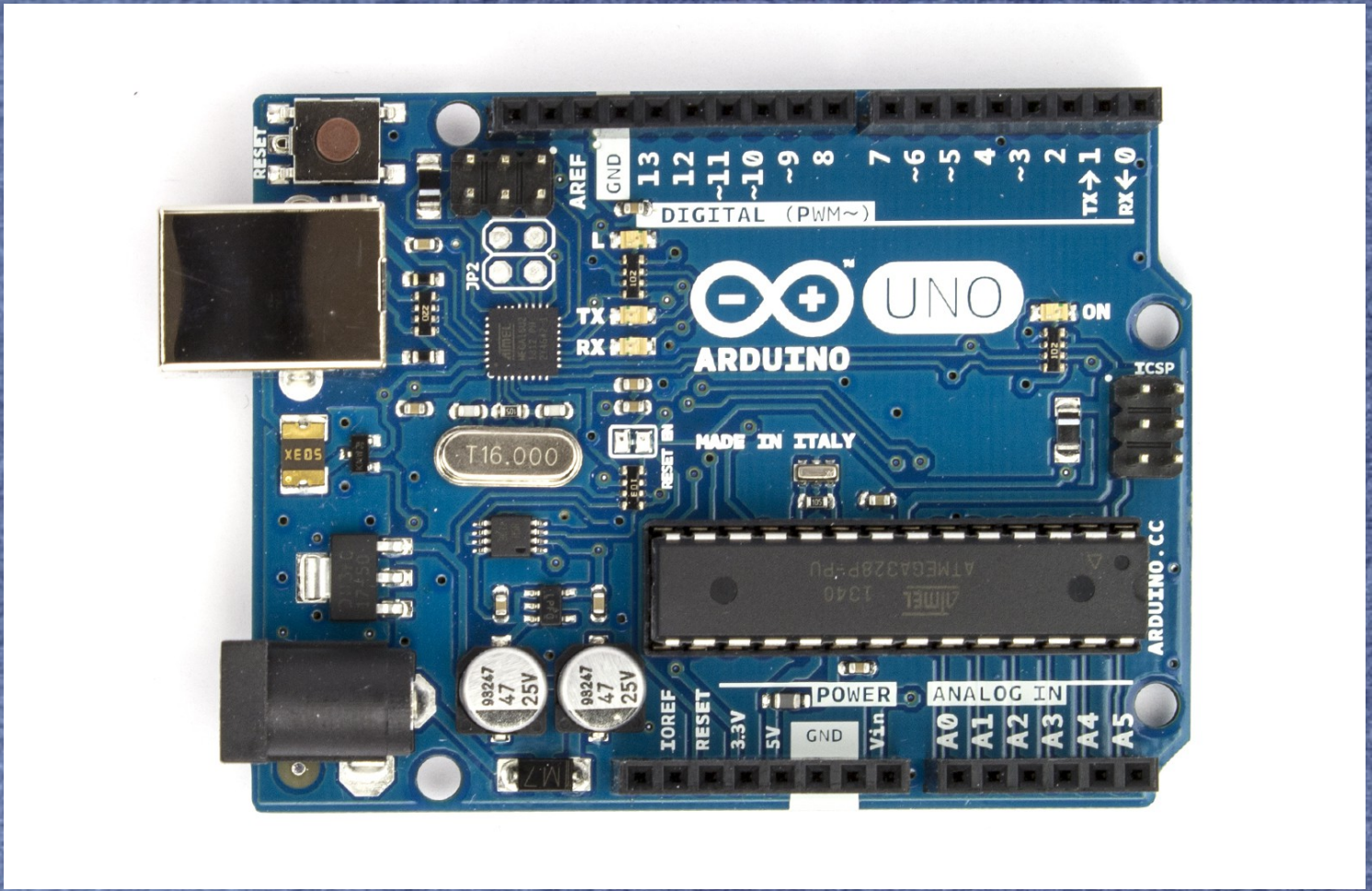


INTRODUCTION TO THE ARDUINO

KEY TO THIS PROGRAM

If you like this program:
Fall asleep with your head forward

If you dislike this program:
Fall asleep with your head backward.

All the heads should be forward
when I am finished :-)

INTRODUCTION TO THE ARDUINO

PROGRAM OUTLINE

I. HISTORY OF THE ARDUINO
II. WHAT IS THE ARDUINO
III. CURRENT ARDUINO LINE
IV. ARDUINO SHIELDS
V. ARDUINO IDE
VI. SAMPLE PROJECT
VII. ARDUINO RESOURCES

INTRODUCTION TO THE ARDUINO

I. HISTORY OF THE ARDUINO

- The Arduino was created in 2005 by a team of professors at an Italian college led by a professor named Massimo Banzi.
- Massimo had taught his students previously using the BASIC STAMP but it was more expensive ($100 price range).

http://spectrum.ieee.org/geek-life/hands-on/the-making-of-arduino

INTRODUCTION TO THE ARDUINO

I. HISTORY OF THE ARDUINO

- Massimo wanted the board to cost, “equivalent of going out to dinner at a pizza place.”
- The name Arduino has an unusual origin: “Ria de Arduino” - The name of a pub in Ivrea, Italy that Massimo and his associates frequented.

http://spectrum.ieee.org/geek-life/hands-on/the-making-of-arduino

INTRODUCTION TO THE ARDUINO

I. HISTORY OF THE ARDUINO

- Arduino has had phenomenal success with over 700,000 “official” boards as of 2013.

- Extensively used by those in the Makers (DIY) movement and embraced by amateur radio operators, the original “makers”.

http://spectrum.ieee.org/geek-life/hands-on/the-making-of-arduino

INTRODUCTION TO THE ARDUINO

II. WHAT IS THE ARDUINO

- The Arduino is a microcontroller with a preloaded bootloader that loads the programmers code upon power up.
- Bootloader (Bootstrap Firmware): Software that runs on power up to set up the necessary environment for user code to execute.

INTRODUCTION TO THE ARDUINO

II. WHAT IS THE ARDUINO

- The Arduino IDE, for writing software is based upon the Processing Programming Language and uses a C and C++ syntax.
- The Arduino hardware interface is based upon the Wiring language.

INTRODUCTION TO THE ARDUINO

II. WHAT IS THE ARDUINO

- The software and hardware is licensed under the open source *Creative Commons Attribution Share-Alike 2.5 license*.

- Commons license information: http://creativecommons.org/licenses/

INTRODUCTION TO THE ARDUINO

II. WHAT IS THE ARDUINO

- Arduino originally used the ATMEL AVR Microcontroller Architecture (ATMega)
- Newest Arduino implementation using an Atmel ARM Controller (Arduino Due)
- There are numerous Arduino clones on the market.

INTRODUCTION TO THE ARDUINO

III. CURRENT ARDUINO LINE

OFFICIAL ARDUINO LINE

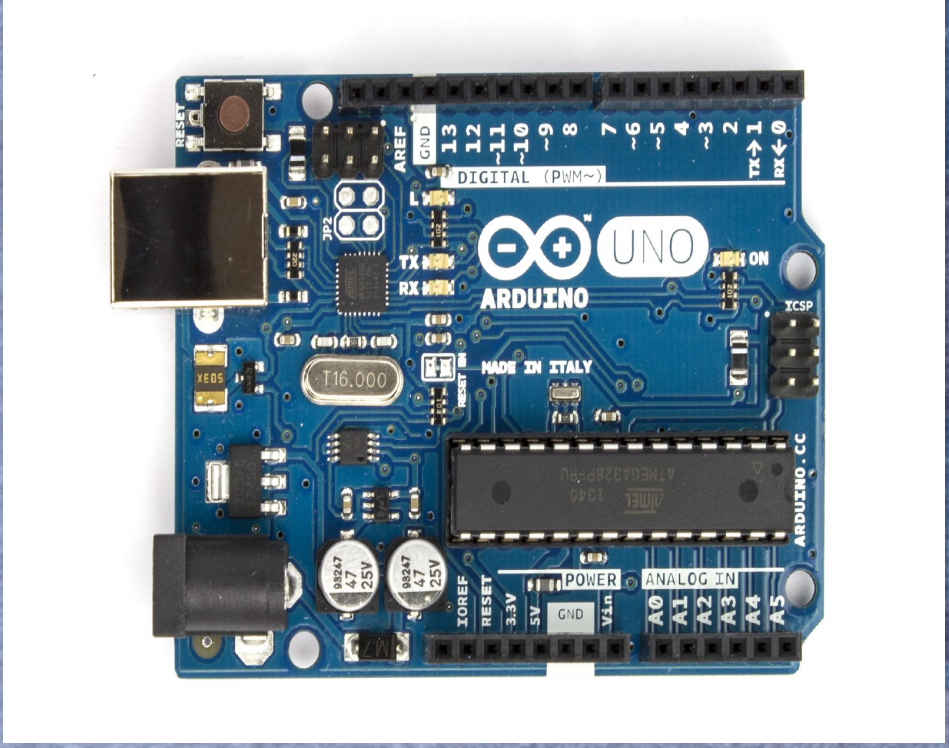
- The following are the most popular Arduino products.
- Full Arduino product line: http://arduino.cc/en/Main/Products

INTRODUCTION TO THE ARDUINO

III. CURRENT ARDUINO LINE

ARDUINO UNO R3

http://arduino.cc/en/Main/ArduinoBoardUno



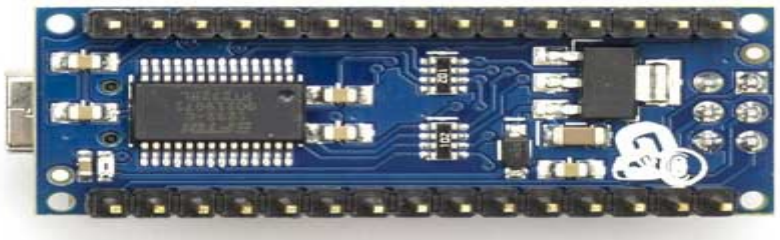
- 8 bit Processor, 16 Mhz Clock, 32K Program Memory.
- Based upon AVR ATMega328U Processor.

INTRODUCTION TO THE ARDUINO

III. CURRENT ARDUINO LINE

ARDUINO NANO:

http://arduino.cc/en/Main/ArduinoBoardNano



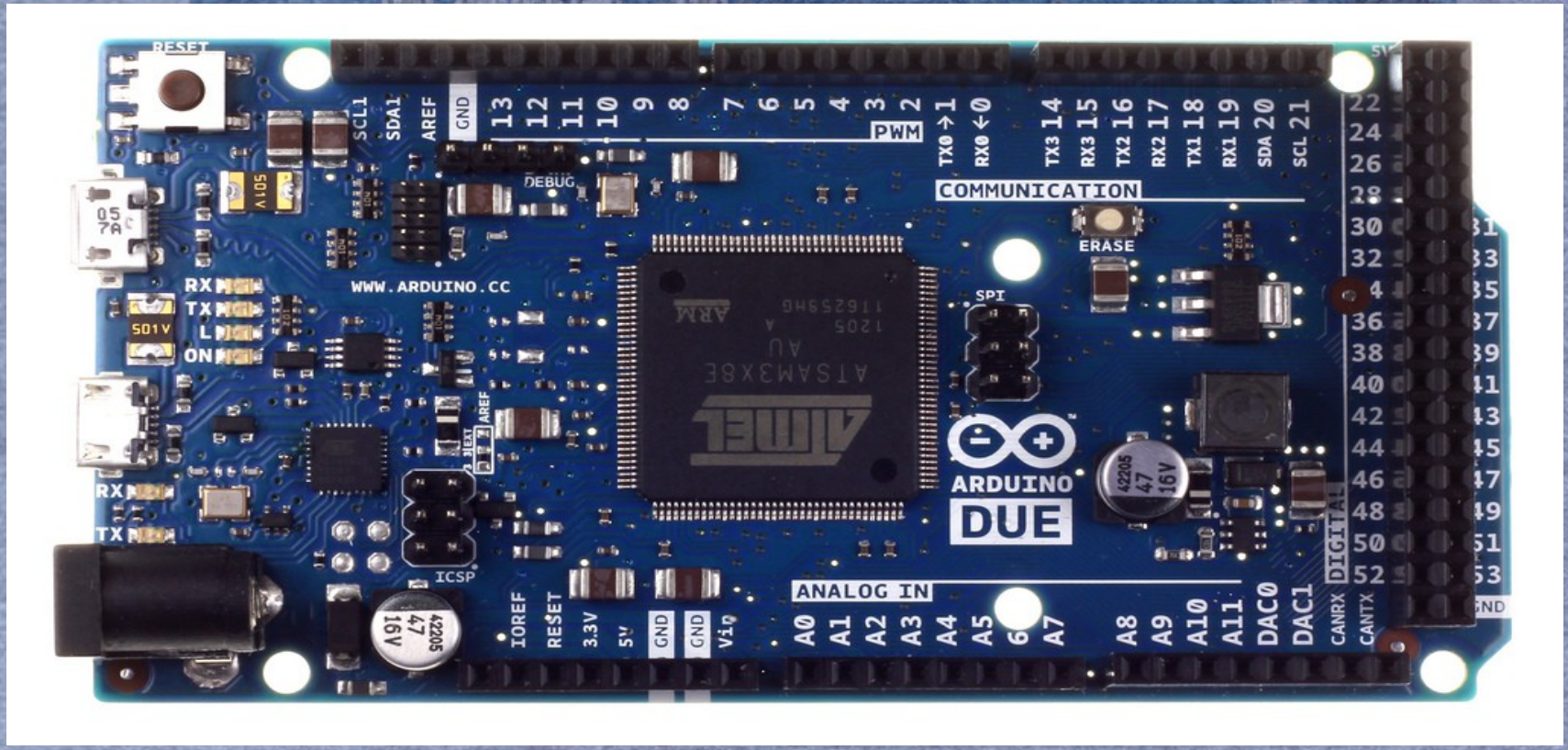
- Arduino that is the size of a 40 pin DIP IC.
- Great for integration into another project.

INTRODUCTION TO THE ARDUINO

III. CURRENT ARDUINO LINE

ARDUINO DUE

http://arduino.cc/en/Main/ArduinoBoardDue



INTRODUCTION TO THE ARDUINO

III. CURRENT ARDUINO LINE

ARDUINO DUE

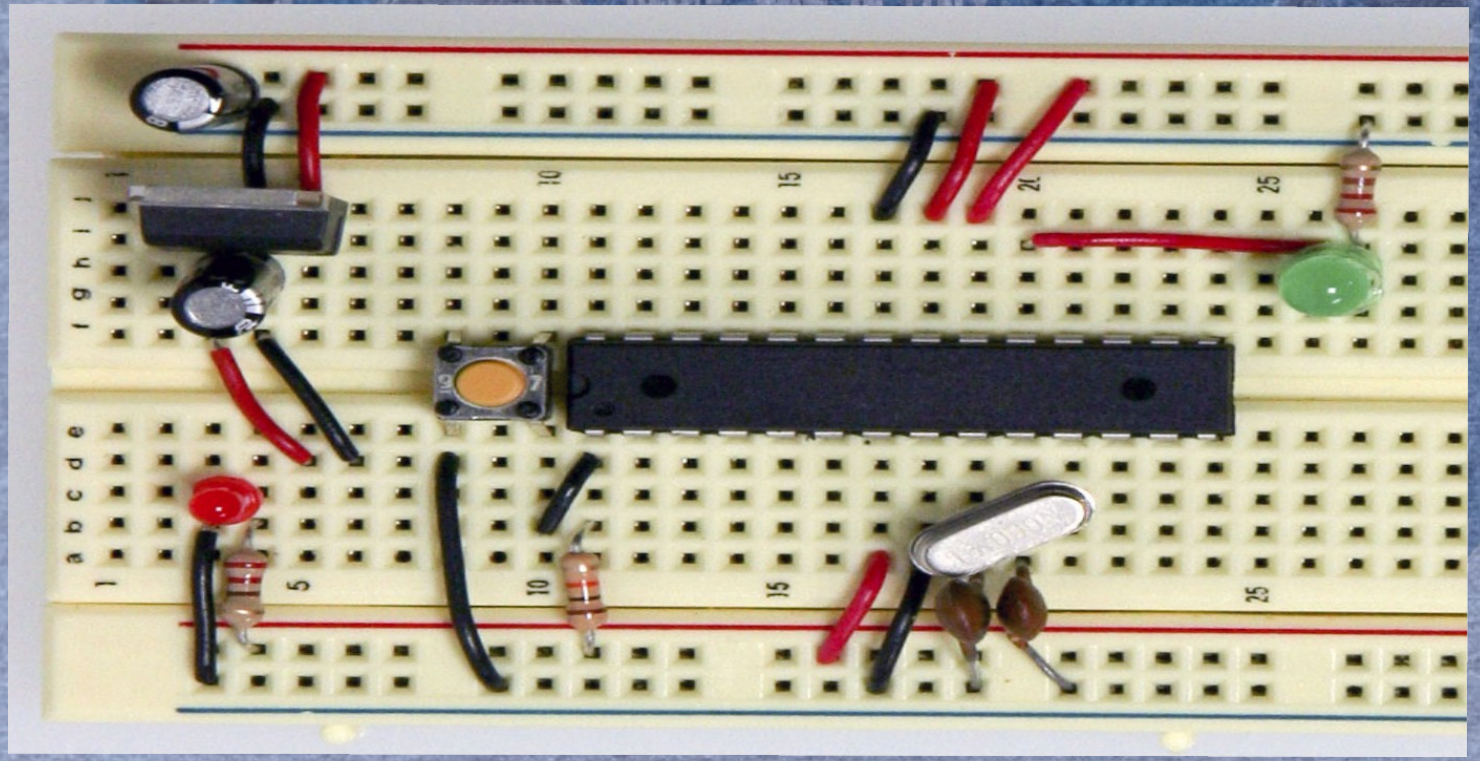
- Based upon an ARM Cortex M3 Processor by ATMEL instead of an AVR processor.
- 32 Bit Processor, Clock speed 84 MHz, 512K Program Memory, 96K RAM, and 54 I/O pins for larger projects.

INTRODUCTION TO THE ARDUINO

III. CURRENT ARDUINO LINE

UNOFFICIAL ARDUINO

Arduino without the board



INTRODUCTION TO THE ARDUINO

IV. ARDUINO SHIELDS

WHAT ARE “ARDUINO SHIELDS”?

- Arduino boards have headers that allow other boards to be plugged into an Arduino.
- These plug in boards are called “Shields”.
- Arduino shields are standardized and can be used with any version of the Arduino.

INTRODUCTION TO THE ARDUINO

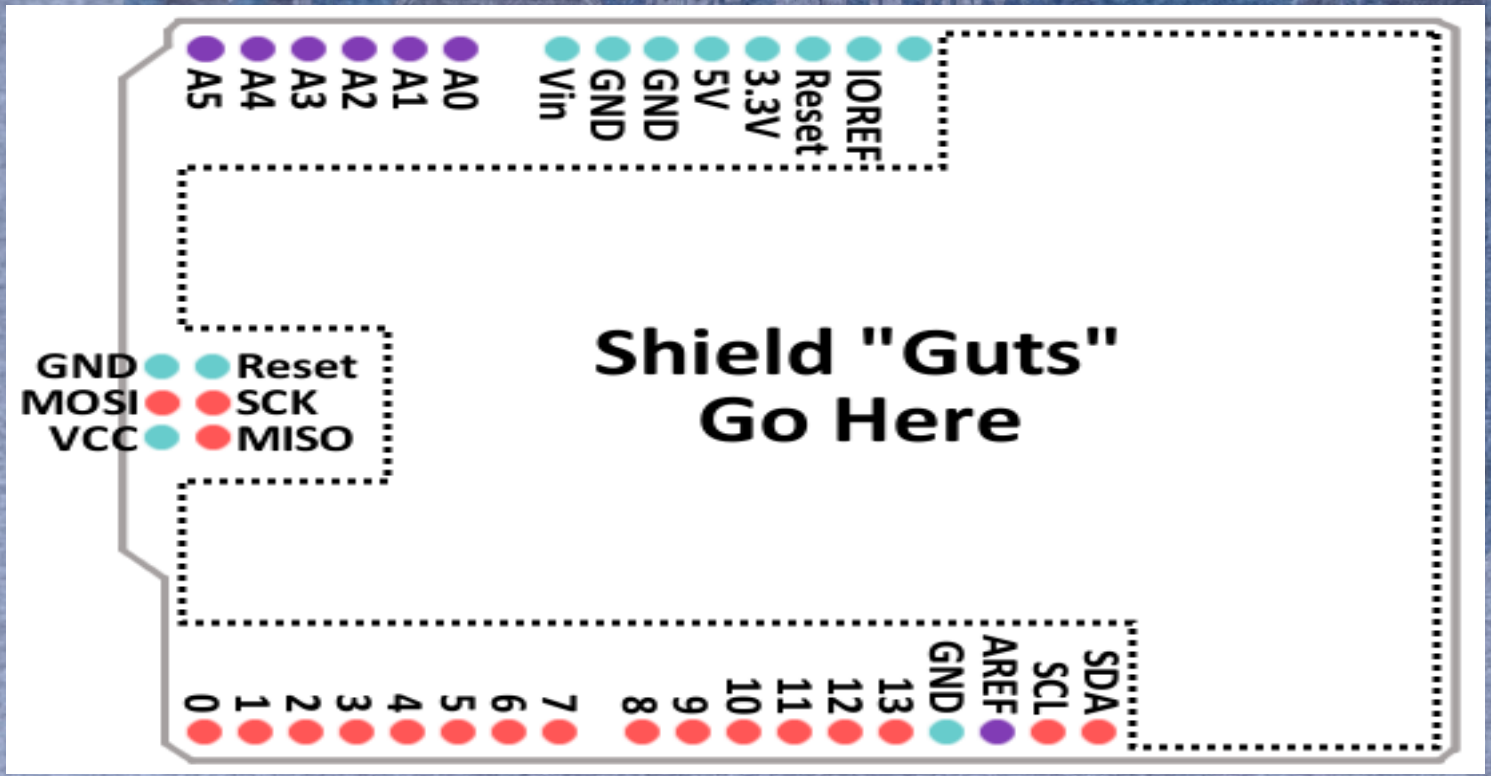
IV. ARDUINO SHIELDS

- Arduino Shields use 0.100” spaced headers and must match the Arduino spacing to be Shield compatible.
- The original Arduino specification had (2) 1 X 6, and (2) 1 X 8 Header rows.
- The newer Arduino shield specification (R3) adds two pins to one of the 1 X 8 headers.

INTRODUCTION TO THE ARDUINO

IV. ARDUINO SHIELDS

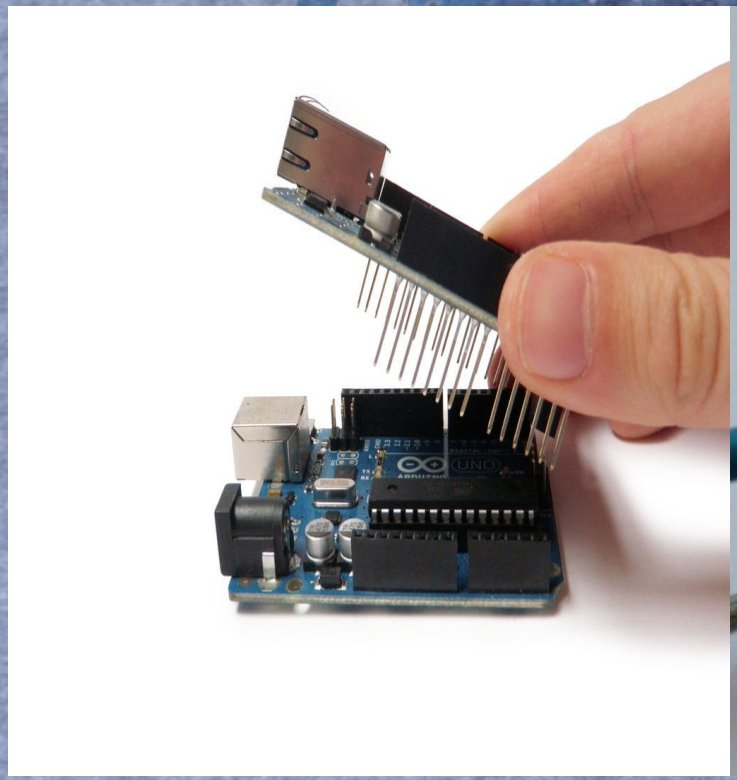
ARDUINO SHIELD PINOUT – R3 VERSION

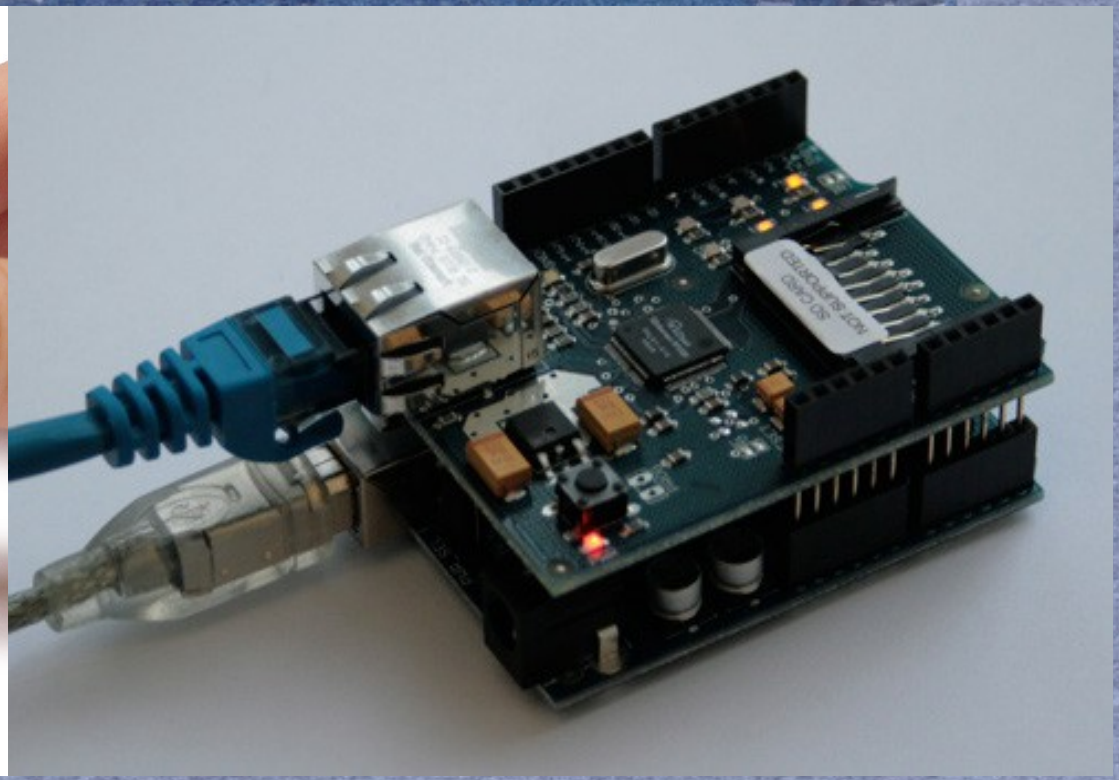


INTRODUCTION TO THE ARDUINO

IV. ARDUINO SHIELDS

SHIELD PLUGGED INTO ARDUINO





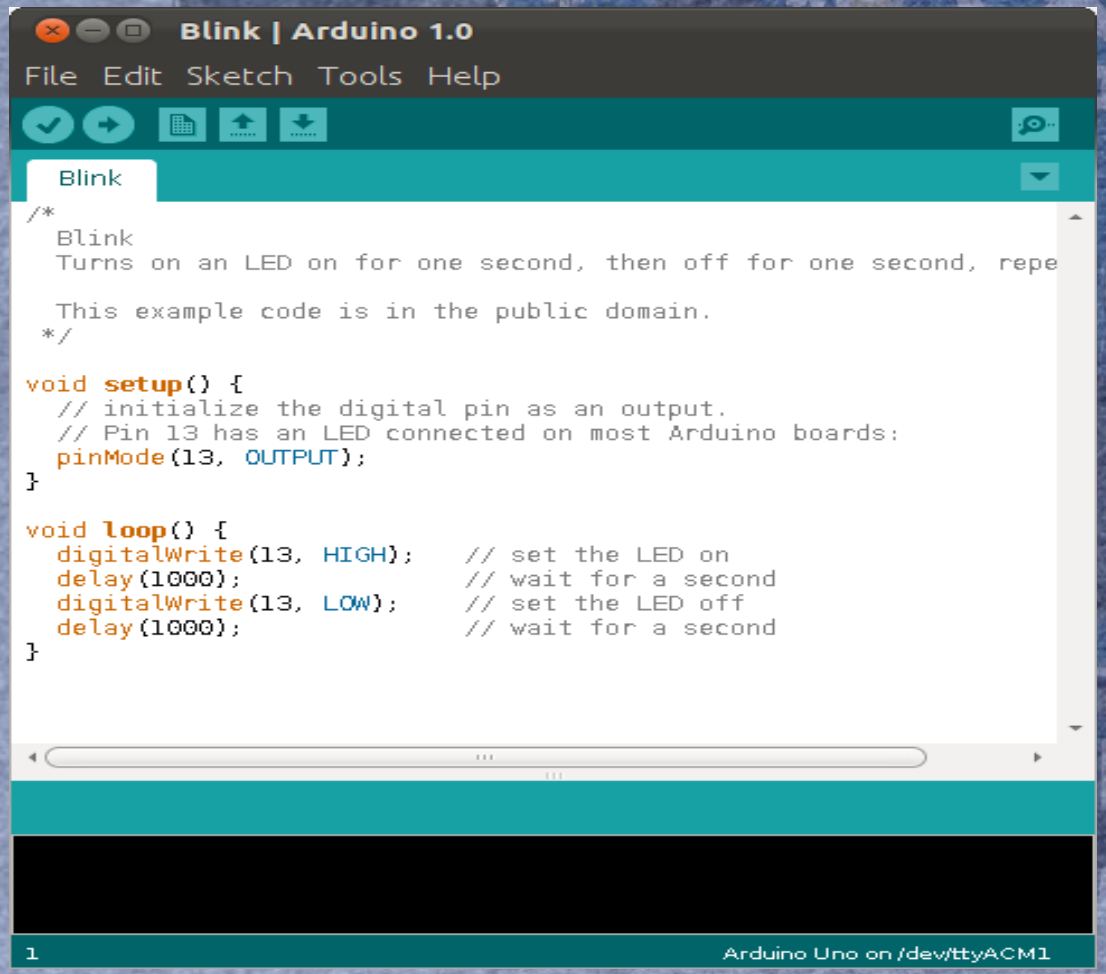
INTRODUCTION TO THE ARDUINO

V. ARDUINO IDE

- Arduino has a standard Integrated Development Environment to write programs, test, debug and load programs onto an Arduino.
- Available for the Windows, Linux, and Mac Operating Systems.
- Free of charge from the Arduino website.

INTRODUCTION TO THE ARDUINO

V. ARDUINO IDE

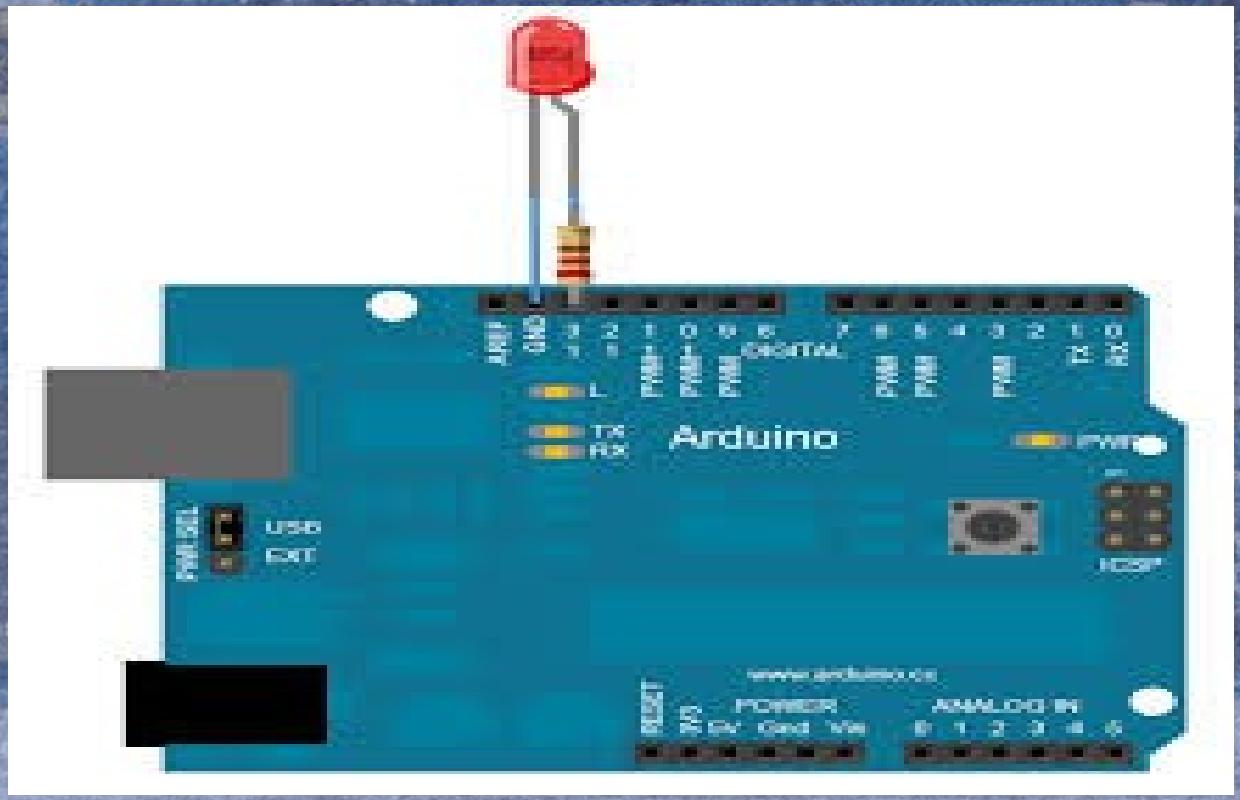

Blink | Arduino 1.0
File Edit Sketch Tools Help
Blink
/*
Blink
Turns on an LED on for one second, then off for one second, repe
This example code is in the public domain.
*/
void setup() {
// initialize the digital pin as an output.
// Pin 13 has an LED connected on most Arduino boards:
pinMode(13, OUTPUT);
}
void loop() {
digitalWrite(13, HIGH); // set the LED on
delay(1000); // wait for a second
digitalWrite(13, LOW); // set the LED off
delay(1000); // wait for a second
}
1
Arduino Uno on /dev/ttyACM1

Screenshot of the Arduino 1.0 development software running a program to make an LED blink.

INTRODUCTION TO THE ARDUINO

VI. SAMPLE ARDUINO PROJECT

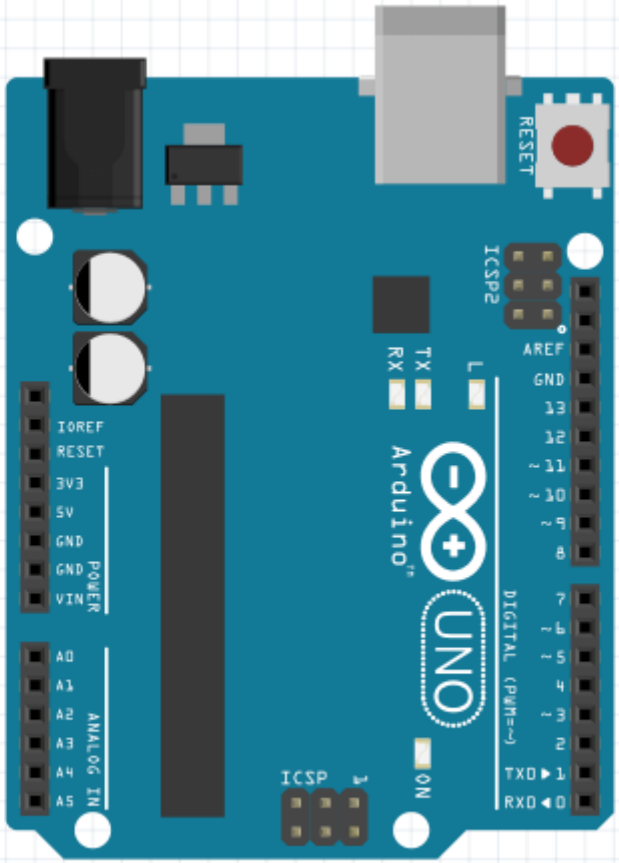
Blinking an LED On and Off



INTRODUCTION TO THE ARDUINO

VI. SAMPLE ARDUINO PROJECT

MCU : Atmega 328
Input voltage : 7V-12V
Operating voltage : 5V
CPU Speed : 16MHZ
Analog In/Out : 6/0
Digital IO/PWM :14/6
EEPROM : 1KB
SRAM : 2KB
Flash : 32KB
UART : 1
USB : Regular



ARDUINO PIN		MICROCONTROLLER PIN
0	-	PD0(RXD)
1	-	PD1(TXD)
2	-	PD2(INT0)
3	-	PD3(INT1)
4	-	PD4
5	-	PD5
6	-	PD6
7	-	PD7
8	-	PB0
9	-	PB1
10	-	PB2(SS')
11	-	PB3(MOSI)
12	-	PB4(MISO)
13	-	PB5(SCK)
A0	-	PC0
A1	-	PC1
A2	-	PC2
A3	-	PC3
A4	-	PC4(SDA)
A5	-	PC5(SCL)

INTRODUCTION TO THE ARDUINO

VI. SAMPLE ARDUINO PROJECT

Blinking an LED On and Off

```
const int LED = 13;  // LED connected to digital pin 13
void setup()
{
      pinMode(LED, OUTPUT); // sets the digital
      // pin as output
}
void loop()
{
      digitalWrite(LED, HIGH); // turns the LED on
      delay(1000); // waits for a second
      digitalWrite(LED, LOW); // turns the LED off
      delay(1000); // waits for a second
}
```

INTRODUCTION TO THE ARDUINO

VI. SAMPLE ARDUINO PROJECT

1. Arduino Ports must be defined first, before any other program code.

This is done by declaring each port with a Global Constant with the *const* command. Constants cannot be changed by any program code.

INTRODUCTION TO THE ARDUINO

VI. SAMPLE ARDUINO PROJECT

2. All Arduino programs must have a minimum of two functions.

- Setup () - This is for code that will run once at the beginning of your program.

- Void() - Contains the core of your program. This is the main loop that runs over and over again.

INTRODUCTION TO THE ARDUINO

VI. SAMPLE ARDUINO PROJECT

- Each module of a program is called a function. Most programs will have numerous functions. The “void ()” function will call upon other functions in its execution.

- The void() will continous loop until you shut the Arduino power source off or push the reset button.

INTRODUCTION TO THE ARDUINO

VI. SAMPLE ARDUINO PROJECT

```
const int LED = 13;     // LED connected to digital pin 13
```

- *The variable “LED” has been assigned a value of 13.*
- *The “const int” defines LED as a constant variable.*
- *Double slashes are used for comments. Comments are ignored by the compiler. They are a programmers aid. Good programmers use them generously.*

INTRODUCTION TO THE ARDUINO

VI. SAMPLE ARDUINO PROJECT

```
void setup()

{
    pinMode(LED, OUTPUT); // sets the digital pin 13 as
     output
}
```

INTRODUCTION TO THE ARDUINO

VI. SAMPLE ARDUINO PROJECT

- *The variable “LED” has been assigned a value of 13.*
- *The command “pinMode” is the command used to assign the pin number and whether it is an output or input.*
- *Double slashes are used for comments. Comments are ignored by the compiler. They are a programmers aid.*

INTRODUCTION TO THE ARDUINO

VI. SAMPLE ARDUINO PROJECT

```
void loop()
{
    digitalWrite(LED, HIGH); // turns the LED on
    delay(1000); // waits for a second
    digitalWrite(LED, LOW); // turns the LED off
    delay(1000); // waits for a second
}
```

INTRODUCTION TO THE ARDUINO

VI. SAMPLE ARDUINO PROJECT

- *The command “digitalWrite” (variable “LED” still has a value of 13) makes that port go High.*
- *The command “delay” is a time pause and the value is in milliseconds.*
- *This routine will turn the LED on and off in 1 second intervals.*
- *This program will run until you turn the power off or push the reset button.*

INTRODUCTION TO THE ARDUINO

VII. ARDUINO RESOURCES

BOOKS:

Getting Started with the Arduino
by Massimo Banzi: ISBN 978-1-449-309879

Arduino for Ham Radio (ARRL)
Gwen Popiel KW5GP: ISBN 978-1-62595-016-1

Beginning Arduino Programming
by Brian Evansl: ISBN-13: 9781430237778

INTRODUCTION TO THE ARDUINO

VII. ARDUINO RESOURCES

BOOKS:

Arduino Notebook V1.1
by Brian Evans (found on Arduino website)
http://playground.arduino.cc/uploads/Main/arduino_notebook_v1-1.pdf

Introduction to Arduino
by Alan Smith (Free Ebook and website)
http://introtoarduino.com/downloads/IntroArduinoBook.pdf

INTRODUCTION TO THE ARDUINO

VII. ARDUINO RESOURCES

WEBSITES – Just to get started with:

Arduino Website: http://www.arduino.cc

Arduino Playground: http://playground.arduino.cc/

Arduino Wikipedia page: http://en.wikipedia.org/wiki/Arduino/

INTRODUCTION TO THE ARDUINO

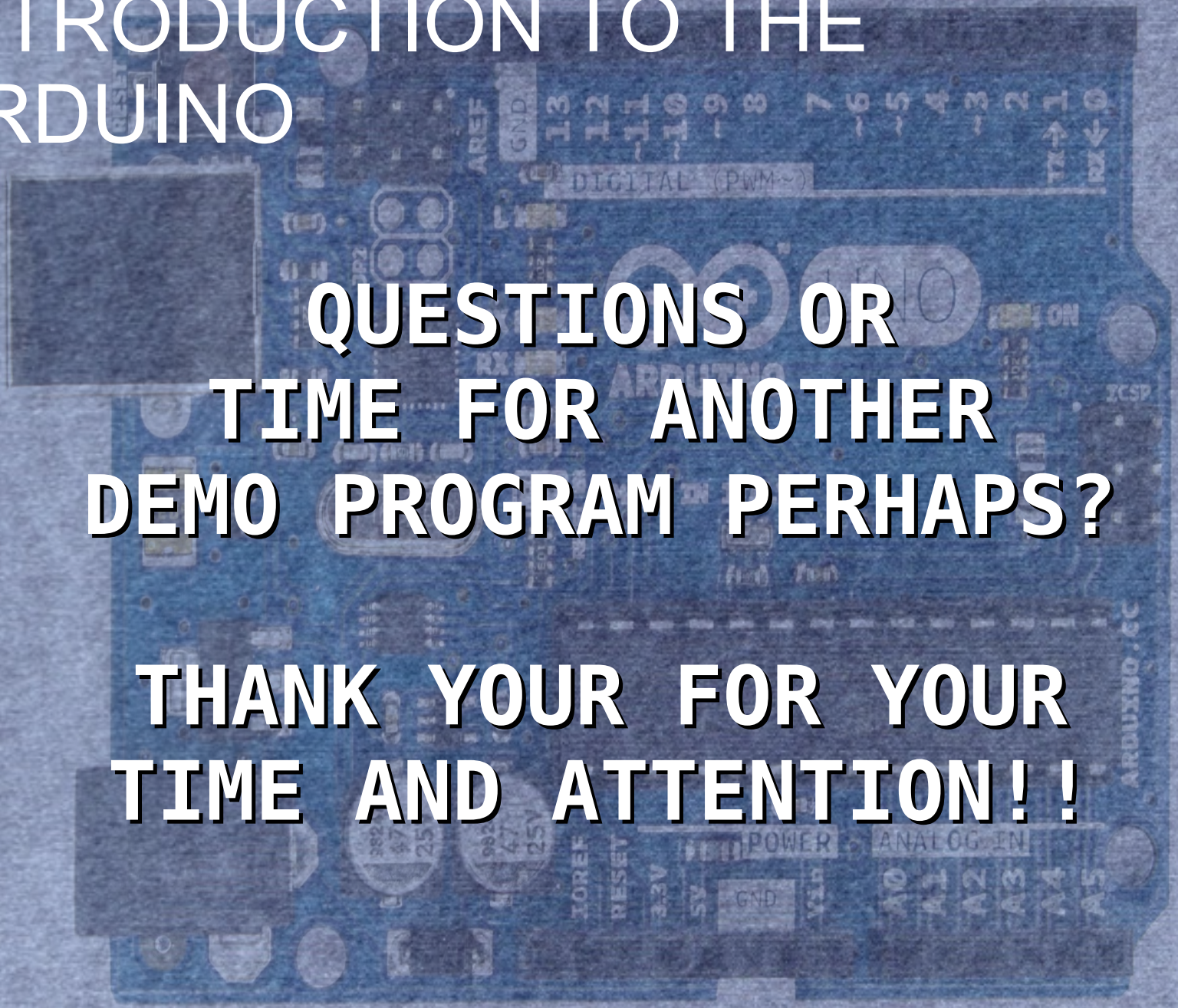
VII. ARDUINO RESOURCES

WEBSITES – Just to get started with:

Arduino UNO Wiki:
http://www.seeedstudio.com/wiki/Arduino_UNO

Arduino Video Tutorials:
Search for Jeremy Blum Arduino Tutorial
Link to first video:
https://www.youtube.com/watch?v=fCxzA9_kg6s

INTRODUCTION TO THE ARDUINO



QUESTIONS OR TIME FOR ANOTHER DEMO PROGRAM PERHAPS?

THANK YOUR FOR YOUR TIME AND ATTENTION!!

INTRODUCTION TO THE ARDUINO

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